



IPW

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of

KITANO et al

Atty. Ref.: 160-513; Confirmation No.

Appl. No. 10/594,422

TC/A.U.

Filed: September 26, 2006

Examiner: unknown

For: NITRIDE SEMICONDUCTOR LASER ELEMENT

\* \* \* \* \*

December 4, 2006

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**SUBMISSION OF INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

Attached is a copy of the International Preliminary Report on Patentability (English version) mailed October 5, 2006 and issued in the underlying International patent application.

Please consider this information when examining the above-identified u.s. national stage application.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

By: \_\_\_\_\_

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From the INTERNATIONAL BUREAU

**PCT**

NOTIFICATION OF TRANSMITTAL  
OF COPIES OF TRANSLATION  
OF THE INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY  
(CHAPTER I OR CHAPTER II  
OF THE PATENT COOPERATION TREATY)  
(PCT Rules 44bis.3(c) and 72.2)

To:

SUZUYE, Takehiko  
c/o SUZUYE & SUZUYE  
1-12-9, Toranomom  
Minato-ku, Tokyo 105-0001  
JAPON

**RECEIVED**  
2 OCT. 16 2006 F  
SUZUYE & SUZUYE

Date of mailing (day/month/year) 05 October 2006 (05.10.2006)	
Applicant's or agent's file reference 05S0188P	<b>IMPORTANT NOTIFICATION</b>
International application No. PCT/JP2005/004249	International filing date (day/month/year) 10 March 2005 (10.03.2005)
Applicant Nichia Corporation et al	

## 1. Transmittal of the translation to the applicant.



The International Bureau transmits herewith a copy of the English translation of the international preliminary report on patentability (Chapter I).



The International Bureau transmits herewith a copy of the English translation of the international preliminary report on patentability (Chapter II).

## 2. Transmittal of the copy of the translation to the designated or elected Offices.

The International Bureau notifies the applicant that copies of that translation have been transmitted to the following designated or elected Offices requiring such translation:

None

The following designated or elected Offices, having waived the requirement for such a transmittal at this time, will receive copies of that translation from the International Bureau only upon their request:

AE, AG, AL, AM, AP, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EA, EC, EE, EG, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OA, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

## 3. Reminder regarding translation into (one of) the official language(s) of the elected Office(s).

The applicant is reminded that, where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability (Chapter II).

It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned within the applicable time limit (Rule 74.1). See Volume II of the PCT Applicant's Guide for further details.

The International Bureau of WIPO  
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1211 Geneva 20, Switzerland

Authorized officer

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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 05S0188P	<b>FOR FURTHER ACTION</b>	See item 4 below
International application No. PCT/JP2005/004249	International filing date ( <i>day/month/year</i> ) 10 March 2005 (10.03.2005)	Priority date ( <i>day/month/year</i> ) 26 March 2004 (26.03.2004)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant Nichia Corporation		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 6 sheets, including this cover sheet.  In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	<p>This report contains indications relating to the following items:</p> <table style="width: 100%;"> <tr> <td style="width: 10%; text-align: center;"><input checked="" type="checkbox"/></td> <td style="width: 30%;">Box No. I</td> <td style="width: 80%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<input type="checkbox"/>	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 26 September 2006 (26.09.2006)
Facsimile No. +41 22 338 82 70	Authorized officer  <div style="text-align: center; font-weight: bold;">Yoshiko Kuwahara</div> e-mail: pt07@wipo.int

# PATENT COOPERATION TREATY

TRANSLATION

From the  
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing  
(day/month/year)

Applicant's or agent's file reference

**05S0188P**

**FOR FURTHER ACTION**

See paragraph 2 below

International application No.

**PCT/JP2005/004249**

International filing date (day/month/year)

**10.03.2005**

Priority date (day/month/year)

**26.03.2004**

International Patent Classification (IPC) or both national classification and IPC

Applicant

**Nichia Corporation**

1. This opinion contains indications relating to the following items:

- |                                     |              |  |
|-------------------------------------|--------------|--|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the opinion   |
| <input type="checkbox"/>            | Box No. II   | Priority   |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability   |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention   |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/>            | Box No. VI   | Certain documents cited  |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application   |
| <input type="checkbox"/>            | Box No. VIII | Certain observations on the international application  |

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/JP

Authorized officer

Facsimile No.

Telephone No.

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2005/004249

Box No. I

Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.  
☐ This opinion has been established on the basis of a translation from the original language into the following language  
\_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rule 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material  
☐ a sequence listing  
☐ table(s) related to the sequence listing
  - b. format of material  
☐ in written format  
☐ in computer readable form
  - c. time of filing/furnishing  
☐ contained in the international application as filed.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/JP2005/004249

Box No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Claims 1-14

YES

Claims

NO

Inventive step (IS)

Claims

YES

Claims 1-14

NO

Industrial applicability (IA)

Claims 1-14

YES

Claims

NO

2. Citations and explanations:

(1) Claims 1-3

Document 1 cited in the ISR describes a nitride semiconductor laser element wherein an n-type nitride semiconductor layer, an activation layer and a p-type nitride semiconductor layer are stacked, and a ridge-shaped stripe is provided in the p-type nitride semiconductor layer.

Document 1: JP, 2001-210914, A (Nichia Chemical Industries, Ltd.), 3 August, 2001 (03.08.01), paragraphs [0013]-[0020], Fig. 1 (Family: none)

The above nitride semiconductor laser element is such that a rich layer containing plenty of aluminum and boron is formed near the surface of the side of a ridge-shaped stripe from the surface to the inside, and this is done so as to improve the insulation of the element. Fig. 6 of document 1 describes a nitride semiconductor laser element in which the rich layer is not formed, and a ridge-shaped stripe which was well known in prior art is provided.

A semiconductor element including a nitride semiconductor laser element requires speedup according to its usage, and to comply with this requirement, a technique for reducing the element capacity in an area around a wave guide region is known.

For example, document 2 cited in the ISR describes that an ion is implanted into the semiconductor layer in a peripheral area separated from the wave guide region, and the electric resistance of that part is made high to reduce the depletion layer capacity of the pn-junction.

Document 2: JP, 5-190980, A (The Furukawa Electric Co., Ltd.), 30 July, 1993 (30.07.93), paragraphs [0005]-[0006], Fig. 1 (Family: none)

In a nitride semiconductor laser element which was well known in prior art wherein an n-type nitride semiconductor layer, an activation layer, and a p-type nitride semiconductor layer are stacked, and a ridge-shaped stripe is provided in the p-type nitride semiconductor layer, a person skilled in the art could have easily conceived of forming such a constitution as that of the subject matters of claims 1, 2 or 3 in order to implement speedup by implanting an ion into the semiconductor layer in a peripheral area separated from a wave guide region, and reducing the depletion layer capacity of the pn-junction.

(2) Claim 4

Described below is the result of studies of an insulating film. Any other matter is as studied in (1) above.

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Box No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement

In the semiconductor laser element described in document 1, an insulating film is formed on the side of a ridge stripe formed in a p-type semiconductor layer and on the surface of a p-type semiconductor layer.

Document 3 cited in the ISR describes that a first insulating film (301) is formed on the side of a ridge stripe formed in a p-type semiconductor layer and on the surface of a p-type semiconductor layer, and a second insulating film (302) which covers part of the first insulating film and extends up to the side of a wave guide region is formed.

The first insulating film corresponds to the embedded insulating film described in claim 4, and the second insulating film corresponds to the protective insulating film described in claim 4.

Document 3: JP, 2002-237661, A (Nichia Chemical Industries, Ltd.), 23 August, 2002 (23.08.02), paragraph [0062], Fig. 2 (Family: none)

A person skilled in the art could have easily applied a technique for forming the insulating film in the nitride semiconductor laser element described in document 3 instead of the insulating film in the nitride semiconductor laser element described in document 1 to form such a constitution as that of the subject matter of claim 4.

(3) Claim 5

The peak value of impurity concentration of an insulation region formed by ion implantation is set as required according to the degree of dielectric strength. For example, document 4 cited in the ISR describes that the carbon concentration of the insulation region formed by the ion implantation of carbon is about  $1.0 \times 10^{20} \text{ cm}^{-3}$ .

Document 4: JP, 2003-264346, A (Sanyo Electric Co., Ltd.), 19 September, 2003 (19.09.03), paragraph [0052] (Family: none)

Judging from this fact, no special meaning can be found in setting the impurity concentration of the insulation region to a level of  $1 \times 10^{18}$  to  $5 \times 10^{21} \text{ atoms/cm}^3$  described in claim 5.

(4) Claim 6

The range in the depth direction of an impurity concentration distribution in an insulation region is determined depending upon up to which semiconductor layer among the semiconductor layers constituting a semiconductor laser element is insulated, and a person skilled in the art could have easily set it as required, so no special meaning can be found in setting said range to a level of 20 nm to 1  $\mu\text{m}$  from the surface described in claim 6.

Meanwhile, according to the description of paragraphs [0055]-[0057], the range in the depth direction of an impurity concentration distribution of an insulation region in the nitride semiconductor laser element described in document 4 is about 0.15  $\mu\text{m}$  or 0.23  $\mu\text{m}$ .

(5) Claims 7-8

Document 3 discloses that a p-side ohmic electrode (201) (which corresponds to a first electrode described in claims 7 and 8) formed on a p-type semiconductor layer is formed so as to cover part of a first insulating film (301), and a p-side pad electrode (202) comes into contact with the p-side ohmic electrode and covers part of a second insulating film.

In consideration of an electric current channel in a semiconductor laser element, a person skilled in the art could have easily conceived of including an embedded insulating film and the

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2005/004249

Box No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement

lower-part region of the first electrode or pad electrode when an insulation region is provided.

(6) Claims 9 and 14

When the element capacity in a peripheral area of a wave guide region is reduced to implement speedup as described in document 2, what degree of response is required therefor can be set as required by a person skilled in the art, and no special meaning can be found in setting the response to the input of a pulse driving electric current to 1 ns or less as described in claim 9 or 14.

(7) Claim 10

When the element capacity in a peripheral area of a wave guide region is reduced as described in (1) above, what degree of withstand voltage the insulation region for reducing the element capacity should have can be set as required by a person skilled in the art, and no special meaning can be found in setting the withstand voltage to 10 V or more.

(8) Claims 11-13

As a technique for reducing the element capacity of a semiconductor laser element, it is a well-known technique to make at least part of a second electroconductive type semiconductor layer in the depth direction a first electroconductive type semiconductor layer in a peripheral area separated from the wave guide region. For example, document 5 cited in the ISR describes that an n-type current blocking area (4b) is formed on a p-type upper first clad layer.

Document 5: JP, 63-222488, A (Rohm Co., Ltd.), 16 September, 1988 (16.09.88), page 2, upper left column, lines 4-9, page 2, lower right column, line 16 to page 3, upper left column, line 4, Figs. 1(D), 7(B) (Family: none)

It is clear as disclosed in Fig. 1(D) of document 5 that if an n-type region is provided in part of a p-type semiconductor layer, the p-type semiconductor layer is of a pnpn structure, and it is clear as disclosed in Fig. 7(B) of document 5 that if an n-type region is provided from the surface of a p-type semiconductor layer, the p-type semiconductor layer is of a npn structure.